METAL LEACHING FROM A LIMESTONE QUARRY MINESOIL MADE WITH THERMALLY-DRIED SEWAGE SLUDGE

Balanyà, T.; Hereter, A.; Josa, R.; Bonmatí, M.;
Department of Agri-Food Engineering and Biotechnology. College of Agricultural Engineering of Barcelona. Technical University of Catalonia, Campus Baix Llobregat, Canal Olimpic Av. s/n, 08860 Castelldefels (Barcelona) Spain.
e-mail: teresa.balanya@upc.edu

Keywords: Metals, Thermally-dried sewage sludge, Soil reclamation.

Organic amendment of mining by-products with sewage sludge, is a useful technique used in quarry restoration process to improve substrate quality, especially organic matter and nutrient levels.

Sewage sludge can be dried thermally to reduce drastically its water and pathogen content, but the potentially toxic effects of its heavy metal content must be controlled in the amended soils to avoid a negative environmental impact on the soil and local groundwater.

In order to evaluate the leaching metals from two growth media handled with waste material and thermally-dried sewage sludge, a field study was conducted at container scale (150 L) for 370 days in a limestone quarry near Barcelona (NE, Spain).

Two mineral waste materials from the mine itself were used as substrate: waste of crushing operations (85% fraction > 2 mm , sandy-clay-loam texture, 64% $CaCO_3$) and overburden (62% fraction > 2 mm , loamy texture, 39% $CaCO_3$). The sewage sludge came from three plants (Besós, Sabadell, Mataró). In total 32 containers were placed in the mining area: 24 mixtures (3 sewage sludges x 2 mining by-products x 4 replicates) and 8 controls (2 mineral substrates x 4 replicates). Sewage sludge doses were between 61-106 Mg dry matter/ha.

Six leachates were collected throughout the experiment and they were analysed by atomic absorption spectrometry for Cd, Cu, Cr, Ni, Pb and Zn.

In general, and for the two mineral wastes, after the application of sewage sludge the concentrations of Zn, Ni and Cu increased during the first month. From this moment the values had decreased until similar concentrations to the control, at the end of the experiment.

Levels of Cd, Cr and Pb in leachates were always below the detection limits of analytical technique (Cd < 0.009 mg L^{-1}, Pb < 0.086 mg L^{-1}, and Cr < 0.045 mg L^{-1}).

The Zn was the only metal detected in all leachates. Crushed waste showed a trend to lose more Zn than overburden.

Results for metal losses, on the most harmful scenario were less than 0.6 % of total metal applied at the end of the early 6 months.

In conclusion, after this experiment, the addition of thermally-dried sewage sludge to mining by-products, suggests that the risk to pollute groundwater with heavy metals (Cd, Cu, Cr, Ni, Pb and Zn) is very low. Moreover, legal Spanish requirements about surface water quality were complied (RD 995/2000).